Peer Review Comments on Sections 1 and 4 of EPA's Draft Document
Approach for Estimating Changes in Blood Lead Levels from Lead Wheel Weights

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I. GENERAL IMPRESSIONS

Provide overall impressions (approximately 1/2 page in length) addressing the accuracy of information presented, clarity of presentation, and soundness of conclusions.

My overall impression is that this is a well-conceived and logical documentation on the status of lead exposure in U.S. cities, suburbs and rural locations. It recognizes the seriousness of the exposure problem especially for children living in urban environments. It pulls together a vast literature on details that need addressing when evaluating the issue of lead dust generated from a lead source such as wheel weights, and their effect on lead exposure of the population. It emphasizes childhood exposure and indicates that children living in urban environments are excessively exposed to lead without even considering the effect of wheel weights. The chain of events begins with the loss of leaded wheel weights on the roadway, their pulverization by passing traffic, migration into the surrounding air, the flow of lead dust into the yards and homes where people live. Exposure is then estimated from the existing accumulated lead and the lead generated from wheel weights. The bottom line is that wheel weights contribute minimally to exposure and consequently the blood lead of children and adults. Because lead is an accumulative poison, this perspective does not provide comfort. Small amounts of lead are significant to some members of the population. And as described in this draft, the urban locations that have the largest accumulated quantities of lead in the environment are the same places where wheel weight lead dust from vehicle traffic tends to be maximized as shown in Table 20. This results in environmental health disparities.

There are other ways of gaining perspective about the problem which could further contribute to understanding about wheel weights. For example, there is empirical quantitative data on the tonnages of lead emitted into 90 U.S. cities from the legacy of leaded gasoline usage. Although briefly described in section 3, the total quantities of lead were not elaborated on in section 4 and as a result it is difficult to gain holistic perspective about the problem. The quantities of lead dust emitted by vehicles using leaded gas compared with the quantities of lead contributed to the environment by wheel weights as indicated in this draft document arrives at similar conclusion. There are relevant peer-reviewed journal articles which have bearing on the near roadway exposure scenario that contribute to the understanding about roadways as a continuing source of air lead.

The perspective of the tire dealer, wheel weight expert, illuminates the issue. Loss of wheel weights is the bane of the tire dealer's business; unhappy customers, extra time required to rebalance tires, and the costs from loss of wheel weights are negatives to the business. This suggests that the basic problem is poor design of the wheels and tires on the part of some manufacturers. If the issue is the sale of poorly designed wheels which shed lead into the environment, then a regulatory response may be to ban the use of lead. Since Root's 2000 article was published an alternative response was available, but industry failed to respond appropriately.

II. RESPONSE TO CHARGE QUESTIONS

Provide narrative responses to the three charge questions below.

Charge Question 1: Approach for Near Roadway Scenario

OPPT has developed a near roadway exposure assessment scenario which outlines the method used to estimate the lead exposure of children and adults living near generic roadways where lead wheel weights have abraded. Chapters 1 and 4 of the *Approach for Estimating Changes in Blood Lead Levels from Wheel Weights* document provide an overview of the methodology as well as details about the parameter selection.

Question 1. Please comment on the overall approach for the near roadway scenario. Are the modules, default scenarios and assumptions reasonable and adequately supported by relevant scientific data? If not, specifically note why assumptions are unreasonable and provide suggestions and references to support alternate default assumptions.

Comments:

The assumptions are reasonable and the scenarios are logically consistent with the literature. The information about "background" lead could be improved. For example, according to the U.S. Geological Survey, non-urban soils outside of every U.S. city contain small quantities (median 16.5 mg/kg) of Pb (Gustavsson et al. 2001). In addition, two recently published studies about the quantities of lead additives in vehicle fuel and their estimated emissions provides more specific details about the legacy lead that has accumulated and their continuing effects on inhabitants of built environments of the U.S. (Mielke et al., 2010; Mielke et al. 2011a). The effect of accumulated lead dust is captured by a study of soil lead and blood lead within inner city and outer city public and private properties of New Orleans (Mielke et al. 2011b). Zahran et al.(2011) further elaborate on the associations between lead dust contaminated soil, blood lead and age of child in New Orleans.

Charge Question 2: Vehicular Wheel Weight Loss Rates and Abrasion Rates

In order to estimate lead emission rates from a roadway associated with lead wheel weights, the loss rates from vehicles and the wheel weight abrasion rates are needed. A literature search returned a single published study (Root, 2000) that quantified the wheel weight loss rates and abrasion rates. This study has limitations as described in the report. The effect of these limitations is explored in the exposure assessment by varying certain key aspects and assumptions and comparing the values against a base case.

Question 2. Please comment on the use of the Root (2000) study to determine the wheel weight throw rates and abrasion. Are the data from the Root (2000) study reasonably used and adequately transparent? If not, specifically note how the data should be used and provide suggestions and references for alternative data usage or sources.

Comments:

Why do lead wheel weights still appear on streets? Determining the physical forces involved when wheel weights are thrown might be an interesting problem for EPA to tackle. The mass of the wheel weight, the speed of the vehicle, the forces involved in hitting bumps, and accelerating and deceleration, are all determinable by mechanistic approaches. (Actually, the problem is more appropriately approached by mechanistic calculations than the mechanistic approach used to estimate childhood or adult lead exposure).

Another approach is to speak with a wheel weight expert. Detailed information about wheel weights is available from local experts, i.e., tire dealers. I spent time with and queried my local tire dealer to find out what he thought about the wheel weight problem. From the first mention of the wheel weight problem he was unhappy about the situation. Customers blame him for the sudden loss of wheel balance because of thrown wheel weights. He showed me the differences between various wheels; some wheels are manufactured with deeper rims and these wheels rarely, if ever, throw weights; these customers do not come back with balance issues. Other wheels, particularly specialty wheels, have either an inadequate or no rim at all. In order to balance the tires on these wheels the weights are glued to the surface of the wheel; however the glue fails and the weights are thrown, especially at high speeds in hot weather. These customers pay extra for fancy rims and are particularly upset when the wheels throw their weights and go out of balance. From this perspective, the problem of thrown wheel weights appears to be the result of poor design of wheels and/or the method of attaching the weights to the wheels.

My tire dealer also showed me the differences in tires. Some manufacturers produce tires in a precision manner whereby the weight of the steel belt and rubber are evenly distributed around the circumference of the tire; these tires need no, or only minimal balancing. This is an alternative way for achieving a significant reduction in wheel weight use.

Now over ten years after the original Root article, wheel weights are still found on the streets of our cities. Root is correct: Wheel weights have become the major continuing source of lead dust pollution of the roadway environment. The problem is preventable. Through better engineering the wheel industry could have produced wheels and weights that securely attach to the rim; and the tire industry could have adjusted their manufacturing methods to prevent or minimize the use of wheel weights. Neither of these actions has occurred and one can still find thrown wheel weights on U.S. streets.

Charge Question 3: Estimation of Lead Dust Generation from Roads

In order to estimate the lead dust generated from the roadway, a steady-state mass balance model was developed which took into account the amount of lead lost from vehicles, the amount of lead

abraded into dust and the removal of lead wheel weights by street cleaning. The applicable model inputs were set using data from the literature when available. When data were not available or of low quality or quantity, the model results were evaluated using alternative lower or higher input values.

Question 3. Please comment on the approach for estimating lead dust emissions generation from the roadway. Is the approach for estimating lead dust emissions reasonable and supported by available information? If not, specifically note how the data should be used and provide suggestions and references for alternate data usage or sources.

Comments:

The approach for estimating lead dust emissions generated from the roadway appears to be reasonable. The idea that roadway traffic flows generate lead dust is supported by recent studies that were not included in the draft. These include the Wu et al. (2010) study in Los Angeles which indicates the high lead bioavailability of near highway soil. Another published study is Laidlaw et al. (online 2011) indicating the strong association between re-suspended soil and air lead in Birmingham, Chicago, Detroit and Pittsburgh; there was also a significant reduction of air lead during low traffic periods (weekends and federal holidays) compared with high traffic flow periods (weekdays). The role that dry and wet weather plays on the increasing and decreasing lead dust and its influence on children's blood lead has also been evaluated for Syracuse, Indianapolis, and New Orleans (Laidlaw et al. 2005). While the mass of wheel weight lead is small compared with the legacy lead from gasoline additives, the continuing accumulation of lead dust from wheel weights exacerbates the lead dust problems plaguing U.S. cities. This is an unnecessary and totally preventable source of lead dust.

III. SPECIFIC OBSERVATIONS

Provide specific observations, corrections, or comments on the document, mentioning page, paragraph, and/or line number.

The citations in the above comments are listed below:

Gustavsson N, Bølviken B, Smith DB, Severson RC. 2001. Geochemical landscapes of the conterminous United States—new map presentations for 22 elements. Denver CO: US Geological Survey Professional Paper 1648. See the Lead Map, p. 22.

Laidlaw M.A.S., Zahran S., Mielke H.W., Taylor M.P., Filippelli G.M. (online 2011). Re-suspension of lead contaminated urban soil as a dominant source of atmospheric lead in Birmingham, Chicago, Detroit and Pittsburgh, USA. Atmospheric Environment, doi:10.1016/j.atmosenv.2011.11.030.

Laidlaw M. A. S. , Mielke H.W., Filippelli G.M., Johnson D. L., Gonzales, C.R. 2005. Seasonality and Children's Blood Lead Levels: Developing a Predictive Model using Climatic Variables and Blood Lead Data from Indianapolis, Indiana, Syracuse, New York and New Orleans, Louisiana (USA). Environmental Health Perspectives; 113 (6): 793-800.

Mielke H.W, Laidlaw M.A.S., Gonzales C.R. 2010. Lead (Pb) Legacy from vehicle traffic in eight California urbanized areas: Continuing influence of lead dust on children's health. Science of the Total Environment 408, 3965–3975. DOI.org10.1016j.scitotenv.2010.05.017

Mielke H.W., Laidlaw M.A., Gonzales C.R. 2011a. Estimation of leaded (Pb) gasoline's continuing material and health impacts on 90 US urbanized areas. Environment International 37, 248-257. DOI: 10.1016/j.envint.2010.08.006.

Mielke, Howard W., Gonzales, Chris R., and Mielke Paul W., Jr. 2011b. The continuing impact of lead (Pb) dust on children's blood lead: Comparison of public and private properties in New Orleans. Environ. Res. 111 (8), 1164-1172. doi:10.1016/j.envres.2011.06.010.

Wu J, Edwards R, Xueqin (E) He, Liu Z, Kleinman M. Wu J. 2010. Spatial analysis of bioavailable soil lead concentrations in Los Angeles, California. Environ Res 110(4):309-17. doi:10.1016/j.envres.2010.02.004.

Zahran, S., Mielke H.W., Weiler S, Gonzales C.R. 2011. Nonlinear Associations between Blood Lead in Children, Age of Child, and Quantity of Soil Lead in Metropolitan New Orleans. Sci. Tot. Environ. 409(7):1211-1218. DOI: 10.1016/j.scitotenv.2010.11.036.